MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2018/2019

EME2036 - MANUFACTURING AND OPERATIONS MANAGEMENT

(ME/RE)

28 MAY 2019
2.30 p.m. - 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 8 pages excluding cover page with 4 Questions.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

Question 1

(a) Actual demand over the last 8 months for a car sale is shown in the chart below.

1) Compute the 3-month simple moving average forecast for March.

[5 mark]

2) Compute the 3-period weighted moving average with the weights (0.5, 0.3, 0.2).

[5 mark]

3) Compute the exponential smoothing forecast for March assuming an initial forecast of 100? Alpha = 0.4 **[5 mark]**

Table Q1 (a)

Month	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
Forecast	100	110	125	130	145	160	160	150
Orders	96	110	106	115	127	105	100	125

(b) A company has determined the "demand points" and their relative locations in Melaka as follows:

Table Q1 (b)

Demand Points	*X* Coordinate (km)	*Y* Coordinate (km)	Load (tons)
A	12	15	1000
B	22	9	450
C	16	14	750
D	14	15	550
E	8	12	650
F	4	16	600

1) If a company desires to locate a manufacturing facility at the center of gravity, what would be the x and y coordinates of the facility?

[5 Marks]

2) Using rectilinear distance, what is the resulting load–distance score for this location?

[5 Marks]

Continued ...

Question 2

(a) Table Q2(a) contains information about an environmental clean-up project. Shorten the project three weeks by finding the minimum cost schedule. Assume that project indirect costs and penalty costs are negligible. Identify activities to crash while minimizing the additional crash costs.

[15 marks]

Table Q2 (a)

Activity	Normal Time (weeks)	Crash Time (weeks)	Cost to crash (RM per week)	Immediate Predecessor(s)
A	7	6	200	None
B	12	9	250	None
C	7	6	250	A
D	6	5	300	A
E	1	1	--	B
F	1	1	--	C,D
G	3	1	200	D,E
H	3	2	350	F
I	2	2	--	G

(b) Twenty-five engine mounts are sampled each day and found to have an average width of 2 inches, with a standard deviation of 0.1 inches. What are the control limits that include 99.73% of the sample means?

[2 marks]

(c) Based on samples of 20 IRS auditors, each handling 100 files, we find that the total number of mistakes in handling files is 220. Find the 95.45% upper and lower control limits.

[8 marks]

Continued ...

Question 3

(a) A large bakery buys flour in 25-kilogram bags. The bakery uses an average of 4,860 bags a year. Preparing and order and receiving a shipment of flour involves a cost of $10 per order. Annual carrying costs are $75 per bag. The bakery operates 290 days a year.

1) Determine the economic order quantity.

[1 mark]

2) How many orders per year will there be?

[1 mark]

3) What is the length of an order cycle?

[1 mark]

4) What is the total annual cost if the EOQ quantity is order?

[2 marks]

(b) The partially completed inventory record for the tabletop subassembly in Table Q3(a) shows gross requirements, scheduled receipts, lead time, and current on-hand inventory.

1) Complete the last three rows of the record for an FOQ of the 110 units.

[5 marks]

2) Complete the last three rows of the record by using the POQ lot-sizing rue, with p = 3.

[5 marks]

Table Q3 (a) Inventory Record Data

	Week									
	1	2	3	4	5	6	7	8	9	10
Gross requirements	90		85		80		45	90		
Scheduled receipts	110									
Project on-hand inventory 40										
Planned receipts										
Planned order releases										

Item: M405 - X Lot Size:
Description: Tabletop Assembly Lead Time: 2 weeks

Continued ...

(c) Seven Stars operates several amusement parks in the Midwest. The company stocks machine oil to service the machinery for the many rides at the parks. Seven Stars needs 30,000 gallons of oil annually; the parks operate 50 weeks a year. Management is unsatisfied with the current supplier of the oil and has obtained two bids from other suppliers. The data are contained in Table Q3(c). Which supplier and which shipping quantity will provide the lowest costs for Seven Stars.

[10 marks]

Table Q3(c) Data for suppliers to Seven Stars

Supplier	Annual Freight Costs Shipping Quantity			Price/gallon	Annual Holding Cost/gallon	Lead Time (wks)	Annual Administrative Cost
	5,000	10,000	15,000				
Sharps	$5,000	$2,600	$2,000	$4.00	$0.80	4	$4,000
Winkler	$5,500	$3,200	$2,900	$3.80	$0.76	6	$5,000

Continued ...

Question 4

(a) Customers in a small retail store arrive at the single cashier at the rate of 10 per hour. The average service time for the cashier is five minutes. Arrivals tend to follow a Poisson distribution, and service times follow an exponential distribution.

1) What is the average utilization of the cashier?

[1 Marks]

2) What is the average number of customers in the system?

[2 Marks]

3) What is the average number of customers in line?

[2 Marks]

4) What is the average time spent in the system?

[2 Marks]

5) What is the average time spent in line?

[2 Marks]

6) If 2 cashiers implemented in the system, what will happen in your answer in part (3) and (4).

[6 Marks]

(b) Use the information in the preceding table and sequence the six jobs using FCFS and EDD. The jobs are listed in the order of their arrival. Calculate the average flow time and average past due. It is now time zero. Which rule gives the best schedule, in your judgement?

[10 Marks]

Table Q4 (b)

Job	Process Time (days)	Due Time (days)	Days Since Arrival
A	2	7	12
B	8	16	9
C	4	4	8
D	10	17	5
E	5	15	3
F	12	18	2

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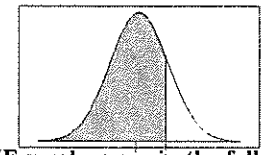
Appendix 1 Standard Normal Cumulative Probability Table



Cumulative probabilities for POSITIVE z-values are in the following table:

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990

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Appendix 2 Factors for calculating three-sigma limits for the x-chart and R-chart

Size of Sample (n)	Factor for UCL and LCL for x-Chart (A_2)	Factor for LCL for R-Chart (D_3)	Factor for UCL for R-Chart (D_4)
2	1.880	0	3.267
3	1.023	0	2.575
4	0.729	0	2.282
5	0.577	0	2.115
6	0.483	0	2.004
7	0.419	0.076	1.924
8	0.373	0.136	1.864
9	0.337	0.184	1.816
10	0.308	0.223	1.777

Process capability:

$$C_{pk} = Minimum\ of \left[\frac{\bar{\bar{x}} - Lower\ specification}{3\sigma}; \frac{Upper\ specification - \bar{\bar{x}}}{3\sigma}\right]$$

$$C_P = \left[\frac{Upper\ specification - Lower\ specificaation}{6\sigma}\right]$$

Inventory Management

$$\text{EOQ} = \sqrt{\frac{2DS}{H}}$$

$$\text{Time between Order} = \frac{Q}{D}$$

$$\text{Number of order per year} = \frac{D}{Q}$$

$$\text{Total annual cost} = \left(\frac{Q}{2}\right)H + \left(\frac{D}{Q}\right)S$$

Supply Chain Management

$$\text{Week of supply} = \frac{Average\ aggregate\ inventory\ value}{Weekly\ sales\ (at\ cost)}$$

$$\text{Inventory turnover} = \frac{Weekly\ sales\ (at\ cost)}{Average\ aggregate\ inventory\ value}$$

Total Annual cost = pD + Freight costs + $(Q/2 + dL)H$ + Administrative costs

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Waiting Line Models Equations:

$$\rho = \frac{\lambda}{\mu} \qquad \rho = \frac{\lambda}{s\mu} \qquad \rho = 1 - P_0$$

$$P_n = (1-\rho)\rho^n \qquad P_n = \begin{cases} \dfrac{(\lambda/\mu)^n}{n!} P_0 & 0 < n < s \\ \dfrac{(\lambda/\mu)^n}{s!\,s^{n-s}} P_0 & n \geq s \end{cases}$$

$$P_0 = 1 - \rho \qquad P_0 = \left[\sum_{n=0}^{s-1} \frac{(\lambda/\mu)^n}{n!} + \frac{(\lambda/\mu)^s}{s!} \left(\frac{1}{1-\rho} \right) \right]^{-1} \qquad P_0 = \left[\sum_{n=0}^{N} \frac{N!}{(N-n)!} \left(\frac{\lambda}{\mu} \right)^n \right]^{-1}$$

$$L = \frac{\lambda}{\mu - \lambda} \qquad L = \lambda W \qquad L = N - \frac{\mu}{\lambda}(1 - P_0)$$

$$L_q = \rho L \qquad L_q = \frac{P_0 (\lambda/\mu)^s \rho}{s!(1-\rho)^2} \qquad L_q = N - \frac{\lambda + \mu}{\lambda}(1 - P_0)$$

$$W = \frac{1}{\mu - \lambda} \qquad W = W_q + \frac{1}{\mu} \qquad W = L[(N-L)\lambda]^{-1}$$

$$W_q = \rho W \qquad W_q = \frac{L_q}{\lambda} \qquad W_q = L_q[(N-L)\lambda]^{-1}$$

End of paper.